SEPTEMBER 3, 1984

$3.00

FORTUNE

C8900-1

CORPORATE WINNERS IN THE LOTTERY BOOM

WHAT THE STOCK MARKET IS SAYING

JAPAN'S LATEST ASSAULT ON CHIPMAKING

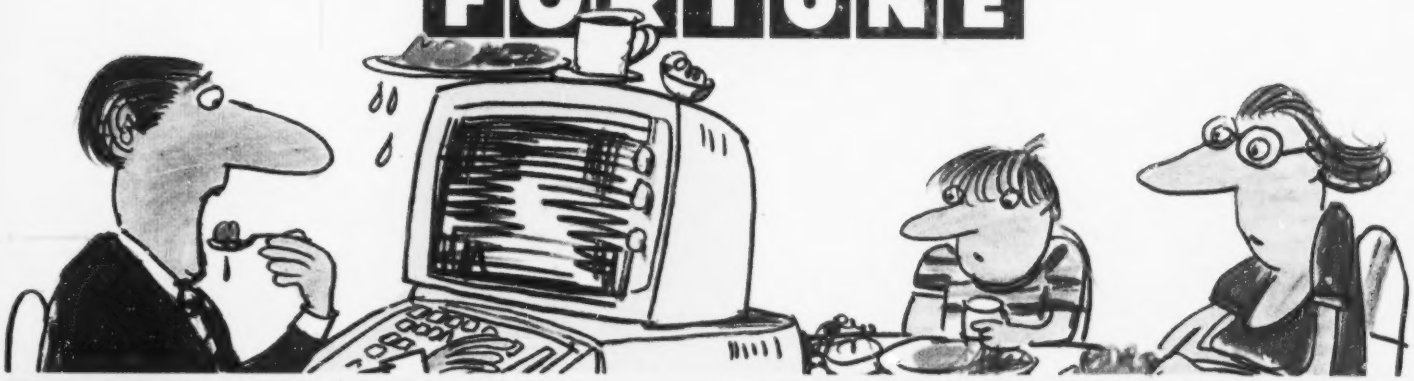
THE MASTER BUILDER OF MAMMOTH TOOLS

Lotto player Venero Pagano won $20 million

*****5-DIGIT 20814
MAY88 000 ES520099Y 52 08 14
CONGR SSNL INFO SVC MD30
4520 EAST-WEST HWY
STE 800
BETHESDA MD 20814

SEPTEMBER 3, 1984 VOL. 110, NO. 5

FORTUNE



On top of the world after winning the New York lottery, Venero Pagano lunched at a pricey restaurant on the 107th floor of the World Trade Center. Arlene Gottfried shot the photo. For companies that are cashing in, see page 20.

COMPETITION

Corporate Winners in the Lottery Boom 20
Businesses from Control Data and General Instruments to corner stores are raking in profits. *by Irwin Ross*

Life After the Lottery 26
Many big lottery winners remain resolutely ordinary folk. *(A picture portfolio)*

THE ECONOMY

Fortune Forecast:
- **The Economy Still Has Lots of Steam** 34
- **Commodity Jitters** 35

MANAGING

How Personal Computers Change Managers' Lives 38
They speed analysis, let managers work at home, and could transform the office power structure. *by Peter Nulty*

CORPORATE PERFORMANCE

The Master Builder of Mammoth Tools 58
Ingersoll Milling, a tough competitor, scorns its industry's pleas for import protection. *by Michael McFadden*

Stodgy Munsingwear Changes Its Underwear 67

Elan's Tasty Dose of the Drug Business 68

SELLING

The Still-Amazing Cigarette Game 70
Everything's going wrong, and profits in this $18-billion-a-year industry are looking terrific. *by Gwen Kinkead*

Searle's Big Pitch for a Tiny Ingredient 73

TECHNOLOGY

Japan's Latest Assault on Chipmaking 76
This time the Japanese are winning business from U.S. builders of chipmaking machinery. *by Bro Uttal*

The Search for Copyproof Software 83

MONEY & MARKETS

What the Stock Market Is Saying 84
It's not the slow-growth less-inflation forecast that you've been reading about. *by Daniel Seligman*

The Firm That Fed on Wall Street's Scraps 89
Having grown fat trading junk bonds and underwriting obscure companies, Drexel Burnham is moving into the first tier. *by Joel Dreyfuss*

POLITICS & POLICY

Putting Showbiz in the Convention 95

Telephone Turf Wars 95

Taking On Takeovers 96

PROFILE

Can Cathie Black Pull *USA Today* Out of the Red? 98
Not for sure. *by Myron Magnet*

People to Watch 101

The Editor's Desk 4

News/Trends 6
Sitting out the bull market, IBM unscathed, Hong Kong's morning after, oil jets, Olympian profits, and more.

Follow-Up 9
American Home cooks up a sale, guard your garbage, Häagen-Dazs feels the heat, and more.

Letters to Fortune 13

Keeping Up 105
by Daniel Seligman

Personal Investing 113
Oil service stocks. Apple Computer. Stocks with stories. Portfolio Talk: Francis Kelly of Oppenheimer & Co.
by Elizabeth S. Silverman

On Your Own Time 127
Walking through Europe.
by Marilyn Wellemeyer

Books & Ideas 133
Alice Rivlin's answers.
by Herbert Stein

JAPAN'S LATEST ASSAULT ON CHIPMAKING

This time the Japanese are winning business from U.S. manufacturers of chipmaking machinery, and more is at stake than the $5.8-billion-a-year semiconductor equipment market. The country with the best hardware may gain a technological edge in chips. ■ *by Bro Uttal*

BEHIND THE NOISY BATTLE between U.S. and Japanese companies to dominate the semiconductor business lies a quieter but equally serious contest. At stake is the $5.8-billion-a-year worldwide market for the machines that churn out the chips. U.S. manufacturers still hold the upper hand, but they've been losing market share to Japanese challengers, whose technology has proved surprisingly good. Some U.S. chipmakers, who bitterly recall their defeat in the most popular computer memory chips—Japanese companies now claim some 55% of that market—think they can see the ideograms on the wall. Michael Hackworth, a senior vice president at Signetics, one of the top ten semiconductor manufacturers in the U.S., says: "Early indications are that the Japanese could win the equipment market too."

Japanese companies have scored the most hits in their home market, which at about $2.5 billion this year is expected to be only $200 million less than the U.S. semiconductor equipment market. Since the 1970s the Japanese have held the largest share of their home market, but only because they dominated sales of older and less sophisticated gear. In 1980, for example, Americans supplied 34% of all types of chip production equipment sold in Japan, but 50% or more of the kinds of advanced hardware needed to make the most powerful memory chips.

Then in 1980 and 1981, says Vice President G. Dan Hutcheson of VLSI Research, a California market analysis group, "Japanese competitors emerged with stunning aggressiveness, slashing away at the U.S. share of their market." Suddenly the Japanese were pushing state-of-the-art equipment in the high-tech end of the market. Techno Systems Research, a Tokyo firm, estimates that the U.S. share of the market for advanced equipment in Japan has dropped to 32%. What's more, 11 Japanese companies have established beachheads in the U.S., where they hope to sell more than $125 million of machinery this year.

The Japanese challenge has galvanized U.S. semiconductor equipment companies, which hope to contain the new competitors by fighting harder in Japan. Many of them are striving for the first time to master the intricacies of selling and servicing high-tech goods in an environment quite different from that of the U.S.

The latest Japanese threat also worries U.S. chipmakers, but not because Japanese equipment can turn out chips superior to those made by U.S. equipment. The Japanese machines excel because they are often more reliable and easier to set up. These are important considerations. A chipmaker's costs depend on yield, the number of good chips that can be sliced from a silicon wafer. Yield typically rises with experience in production, so equipment that goes into production speedily and seldom breaks down can raise yield faster. Chipmakers with the highest yields have the lowest costs and command the largest market shares. The implications for Japanese chipmakers, which get first crack at locally made equipment, are not lost on U.S. competitors.

The rise of Japan's semiconductor equipment companies also gives Japanese chipmakers a better shot at leapfrogging U.S. technology. Chipmakers and equipment suppliers often work together to develop new machines for turning out leading-edge semiconductors. A stronger Japanese equipment industry is better able to give local chipmakers what they need to build advanced chips. While U.S. chipmakers could respond by purchasing Japanese equipment, they would get it months later than their Japanese counterparts, and the head start would be tough to overcome.

Creating electronic circuits on silicon chips is a process akin to lithography. Basically, chipmakers coat a wafer of crystalline silicon with material that raises or lowers the wafer's ability to conduct electricity. Then they cover that material with a light-sensitive film. A machine exposes selected parts of the film by projecting light through a mask having opaque areas that represent the thousands of electronic components in each chip. When the film is developed, the material beneath the exposed areas is etched away by chemicals. The result: a pattern that represents transistors, capacitors, and other elements. Complex chips can have a dozen or more of these patterns layered on top of each other and interconnected. The wafers are tested and sliced into chips, which are slipped into plastic or ceramic casings and bonded to thin gold wires. Processing a single wafer takes from four to six weeks.

Though the work requires plenty of delicate handling by humans, more than 60 kinds of equipment are used. At the low end are electromechanical devices for slicing up the

RESEARCH ASSOCIATE *Kate Ballen*

wafers, bonding the wires, and packaging. Japanese companies have been effective competitors in those areas for more than a decade. The really worrisome Japanese triumphs of late have come at the top of the market in such devices as the photoaligners that project the images onto the chip's surface. Worldwide, the hotly contested aligner business should be worth some $1 billion this year, more than any other segment.

Exposing chips to light is among the most critical steps in production. To improve yield, chipmakers push hard to shrink the size of each chip. This not only produces more chips per wafer, but also cuts down the percentage that are defective, because a flaw in the wafer will ruin a smaller share of the total. Shrinking the chip depends on shrinking the space between its elements, to as little as 2.5 microns (about one-twentieth the diameter of a human hair) on a 64K random access memory (RAM) chip, one that can store up to 65,536 pieces of information. But shrinking carries two big risks. If the image projected on a wafer isn't sharp enough, the edges of closely spaced elements will blur and touch, creating short circuits. And if successive layers of patterns are misaligned, they won't connect properly.

In 1977 GCA Corp. of Bedford, Massachusetts, introduced a new type of photoaligner that answered chipmakers' prayers. Instead of exposing a wafer all at once, it exposed one chip at a time, stepping across the wafer from chip to chip. Known as a stepper, GCA's machine vastly improved resolution. Adjusting focus for each chip instead of for hundreds of chips at a time cut the chance that successive layers wouldn't match up. Steppers can raise the yield of complex chips on a wafer threefold, so it's not surprising that they're in great demand, even though they cost from $400,000 to about $1 million. Hutcheson of VLSI Research estimates that chipmakers worldwide will buy 750 of them this year for some $580 million.

Steppers have been a good business for GCA, accounting for 45% of the company's $195 million in sales last year. Demand for most types of semiconductor equipment is so strong right now—especially for steppers, sales of which are up at least 50% over last year—that GCA and its rivals are operating at capacity. Competition is largely a matter of who can deliver machines fastest. Chipmakers should be able to get 300 steppers from GCA this year—and 250 from Nippon Kogaku, better known as Nikon.

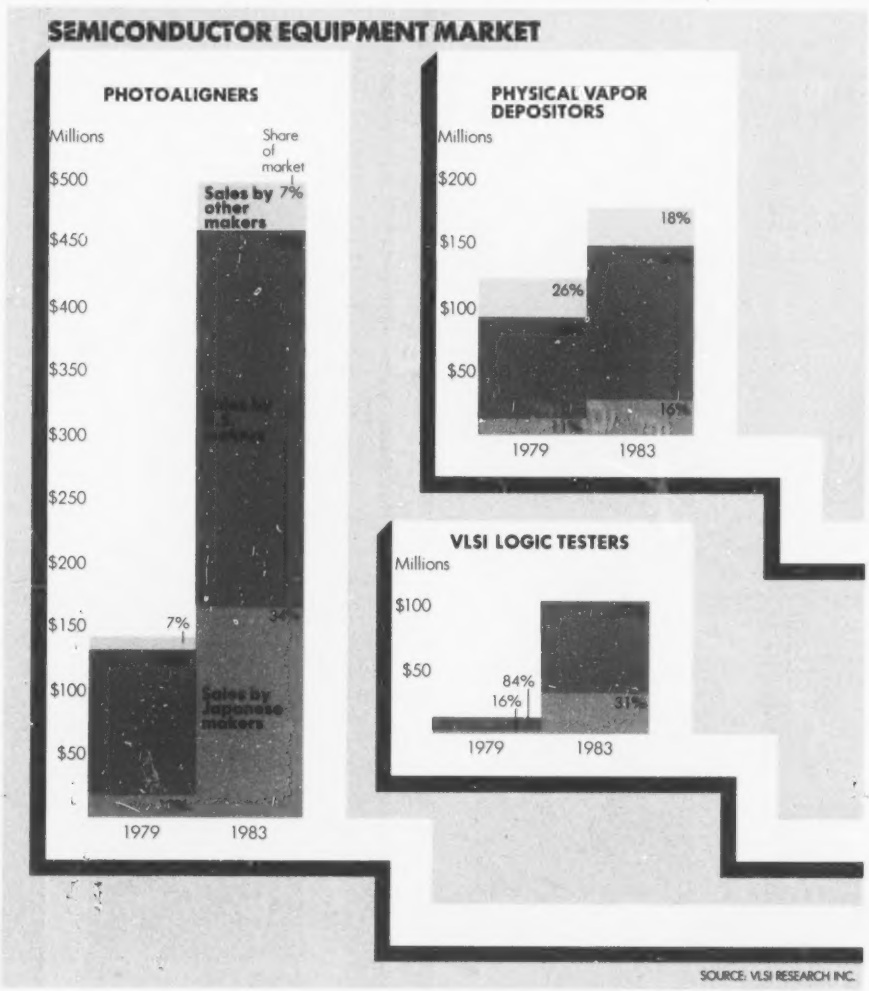
Nikon launched its first stepper just four years ago. That it mastered this fiendishly difficult technology without any previous experience with aligners amazed competitors, who naturally ascribe Nikon's coup to the company's having copied GCA's design. U.S. equipment makers like to call Nikon's stepper "the best GCA stepper made."

NIKON'S ACHIEVEMENT, though, owes less to copying than to Japanese planning. Nikon didn't start from scratch. It is one of the few companies in the world able to make lenses fine enough for chipmaking. And for years Nikon did a small trade in unique optical systems for comparing copies of chipmaking masks with the originals to ensure that defects hadn't crept in when the copies were made. But Nikon hadn't decided to make steppers until some gentlemen from a Japanese group called the VLSI Research Project stopped by. (VLSI stands for very large scale integration, technology that crowds over 100,000 elements onto a silicon chip one-quarter the size of a postage stamp.)

Sponsored by MITI—Japan's famous Ministry of International Trade and Industry—the project was designed to give five of Japan's largest industrial electronics companies the tools to get a head start in VLSI chips. MITI and the five companies—NEC,

Gaining Share at the Leading Edge

Japanese semiconductor equipment companies are coming to the fore with gear for making the most advanced types of chips. Photoaligners project images of electronic elements onto the surfaces of chips. Physical vapor depositors leave very thin coatings of metal on the chips that connect electronic elements on different layers. VLSI (for very large scale integration) testers check the performance of computer logic chips that contain more than 100,000 elements.



Hitachi, Fujitsu, Toshiba, and Mitsubishi Electric—put up $285 million for the project, which doled out development contracts for new equipment. Financial help, says a Nikon executive, was less important than the chance to hook up with customers: "We got to work closely with all five leading companies, who wouldn't normally have disclosed their know-how and their needs to us. After the program ended, the engineers went back to their companies and naturally they wanted our equipment."

The other comer in photoaligners is Canon. Like Nikon, Canon enjoyed the patronage of MITI. Canon has been talking up a new stepper that is supposed to achieve excellent accuracy by aligning through the same lenses that the mask is projected through, somewhat as a single-lens-reflex camera does, instead of aligning through one set of lenses and projecting the image through another. Though Canon is late to market and has yet to announce a large order, it may become a formidable competitor. The company has already gobbled up much of the market in Japan, $48 million last year, for scanning projection aligners, which use a moving beam of light to create an image over the entire wafer. Much of that business used to belong to Perkin-Elmer, the largest producer of semiconductor equipment in the world (estimated 1984 sales: $290 million). Canon feels sure it can double sales of chipmaking gear to $127 million this year and is looking for $194 million in 1985.

Shigeru Nishioka, managing director of Canon's optical products group, claims that many leading U.S. chipmakers are interested in the novel stepper, and that a few have even visited the company's stepper factory in the town of Kosugi. Says a U.S. competitor, "Canon is so aggressive in marketing that when it comes on stream, Nikon will have real problems." So will GCA: that company's largest Japanese customer, Fujitsu, reportedly plans to replace GCA's steppers with Canon equipment.

After aligners, the Japanese have made their greatest strides in automatic testing equipment used both in research and development and in production. Last year Takeda Riken and Ando Electric split 65% of the $159-million Japanese market for testers almost evenly. Takeda Riken America is probably the most successful of all Japanese semiconductor-equipment export operations. Only three years old, it expects to rack up U.S. sales of $40 million this year. Ando is shooting for exports of $16 million.

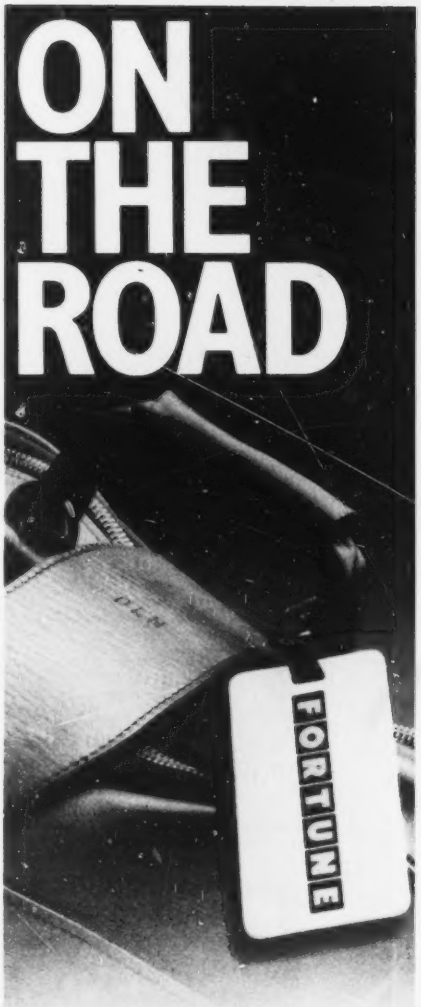
Both companies have prospered partly because Japanese chipmakers have a fetish for reliability and are willing to pay high prices for testers. Just as important, the main U.S. tester company in Japan had been Schlumberger Computer Aided Systems (formerly Fairchild Camera & Instrument), which has proved remarkably maladroit. Schlumberger was late with a whole generation of test equipment because it decided to make drastic design changes a few years ago. Then it split with its skilled Japanese distributor in 1982, having elected to take the risky course of setting up a direct sales operation. "That move opened a vacuum, and Takeda just strolled in," says James Bowen, once head of Schlumberger's tester group and now a vice president of Eaton Corp.'s semiconductor equipment operations. Over the last four years, Schlumberger's share of the tester business in Japan has collapsed from 30% to less than 5%, and it's still deflating.

TAKEDA RIKEN got a special boost from NTT, Japan's state-owned telephone company. NTT guided Takeda in developing the world's fastest research-and-development tester, which runs at 2½ times the speed of today's most popular R&D testers. NTT helped defray the $6-million development cost by committing to buy two of the machines. All told, Takeda has sold only four of these $3.5-million monsters, but the development project led to a significant breakthrough that has bolstered its entire product line. Special hardware Takeda designed for the fast tester guarantees that it will monitor accurate signals as heat builds up in a chip. Takeda uses this design in all its VLSI testers.

At least a dozen other Japanese companies have tried to seize the lead in making exotic devices for wafer processing, such as chambers called plasma etchers that etch chips by immersing them in clouds of electrically charged corrosive gases. Some have gained strong positions, but none have won out over experienced U.S. companies like Varian Associates (estimated 1984 sales of semiconductor production equipment: $190 million) and Applied Materials ($162 million). Japanese customers, it seems, are usually happy to buy American if performance and service are right.

Success in Japan is vital to the future of U.S. equipment companies. Japanese chipmakers will spend proportionally more than their U.S. counterparts on capital equipment this year—around 30% of sales vs. 25%. If the Japanese continue to gain market share in chips worldwide, their equipment purchases will soon eclipse U.S. purchases. The only way for U.S. equipment companies to prevent the Japanese from picking up all of that business and then invading the U.S. in force is to keep shelling them on their home turf.

continued



FORTUNE readers go places.

And no matter where they travel, FORTUNE helps them do it in style with *On the Road.*

Appearing every other issue, *On the Road* is rich with first-hand travel tips for you.

Like where to get a posh and tasty business breakfast in New York. Where to rent an exotic Ferrari in Beverly Hills. How to find just the right hotel in Silicon Valley. And where to sample some surprisingly fine local wines in Seattle or Kalamazoo or Pittsburgh.

You'll always discover something different in *On the Road*—from fancy takeout food in Chicago and Dallas to the few airport hotels that offer a touch of class.

Don't miss *On the Road*—every other issue in FORTUNE.

It can help make your next trip anything but business as usual.

FORTUNE

May we send you a most unique catalog of executive products?

The Executive Gallery brings you an unparalleled collection of exciting new products for business and professional people. From the exclusive new SkyValet™ garment-bag-on-wheels, to a complete line of personal organizers, project management systems, and valuable scheduling tools. From an impressive library of motivational, training and self-improvement audio cassettes, to a broad assortment of fine quality footwear by Allen Edmonds, Nettleton, Bostonian, Pierre Cardin, Yves Saint Laurent and others. Plus a wealth of luxurious leather goods, attaches, exotic reptile accessories, desk sets, photographic equipment, time pieces and gifts. Each item is selected for its ability to increase productivity, improve professional performance, or enhance the executive lifestyle.

For free catalog, write or phone:

The Executive Gallery™
6480 Busch Blvd., Suite 200 Dept. 4215
Columbus, Ohio 43229

800-848-2618 (In Ohio 800-282-2630)

We'll even pamper you with a Radisson "Night to Remember"

Purchase any SkyValet garment-bag-on-wheels from our catalog between September 1 and December 31, 1984 and we will pick up your room tab for a weekend night at any Radisson Hotel. Full details in catalog.

PRIME INDUSTRIAL SHELL $2.27/SQ. FT.!

40,000 Sq. Ft.

Williamsport, PA

Put your business in Central Eastern Pennsylvania and reach 70 million consumers overnight. A 40,000 sq. ft. shell building is available for $2.27 a sq. ft. (annual lease amortization) in the fully-improved, rail-served Williamsport Industrial Park. The location offers easy access to major markets via Rt. 15, Rt. 220 and I-80. Plus, a municipal airport is nearby.

Call us TOLL-FREE for details **1-800-523-9854** In Pa. call collect: 215/770-5580

Joseph R. Lesko, Manager-Economic Development F-9
Pennsylvania Power & Light Company
Two North Ninth Street
Allentown, Pa. 18101

Please send information on Williamsport's 40,000 sq. ft. shell building.

Name _____
Company _____
Address _____
City _____ State _____
Zip _____ Phone _____

CENTRAL EASTERN PENNSYLVANIA

TECHNOLOGY

The difficulty for American suppliers is that Japanese notions of performance and service are at odds with practice in the U.S. Japan's big five electronics companies account for about 60% of demand and either own stakes in or have "family" relations with most of the Japanese equipment companies. So the equipment companies tend to behave like captive suppliers. They take their ideas for new products from the big five, will customize anything, and are fearful of selling equipment that might break down.

By contrast, the executives who run U.S. equipment companies usually concentrate on the daring technology of their machines above all else and expect buyers of leading-edge gear to help work out bugs on the factory floor. "U.S. companies have a misunderstanding," says Tetsuo Iwasaki, the wily president of Applied Materials Japan, a wholly owned subsidiary of Applied Materials in the U.S. "They think the best features will sell the equipment. But most lost sales can be traced to a lack of commitment to the customer, not to a lack of features."

When U.S. equipment makers had a lock on the market in Japan, commitment didn't matter so much. Now that it does, they are finding it risky and fearsomely expensive. It usually means developing a force of service engineers in the field, accepting several years of losses, and eventually setting up a factory in Japan. Materials Research Corp. of Orangeburg, New York, and Schlumberger are taking that route now.

The most sensible strategy for U.S. companies probably is a joint venture with a Japanese manufacturer. And that's the advice many are getting these days from Tokuo Kubo, co-founder and chairman of Tokyo Electron Ltd., known as TEL. Kubo has 50%-owned joint ventures with five U.S. semiconductor equipment companies, distributes gear for 12 others, and manufactures two product lines under licenses from another U.S. company. TEL sold $164 million of chipmaking gear in Japan last year, more than any other company.

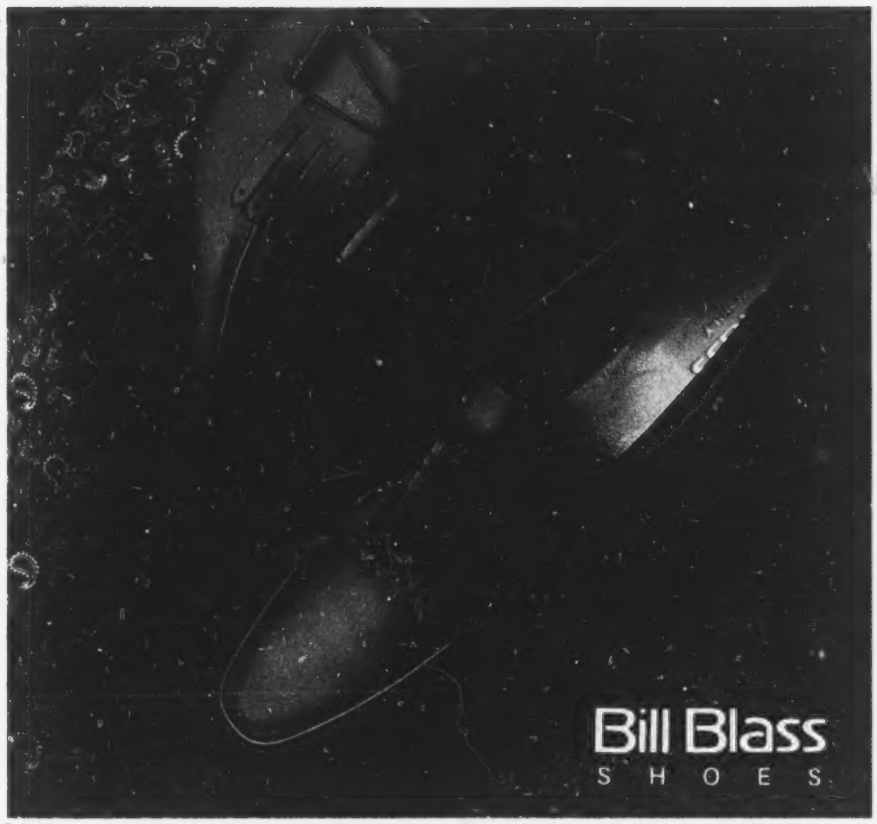
The division of labor between TEL and its partners reflects their respective talents. U.S. companies provide advanced technology. TEL supplies a highly regarded service operation and a staff of engineers to adapt U.S. equipment to local needs, including the need for reliability. Kubo's engineers, for example, have redesigned one of Varian's ion implanters—machines that drive charged particles into silicon to change its electrical properties—so it doesn't break down as of-

ten as the original and won't leak arsenic gas if there's an earthquake.

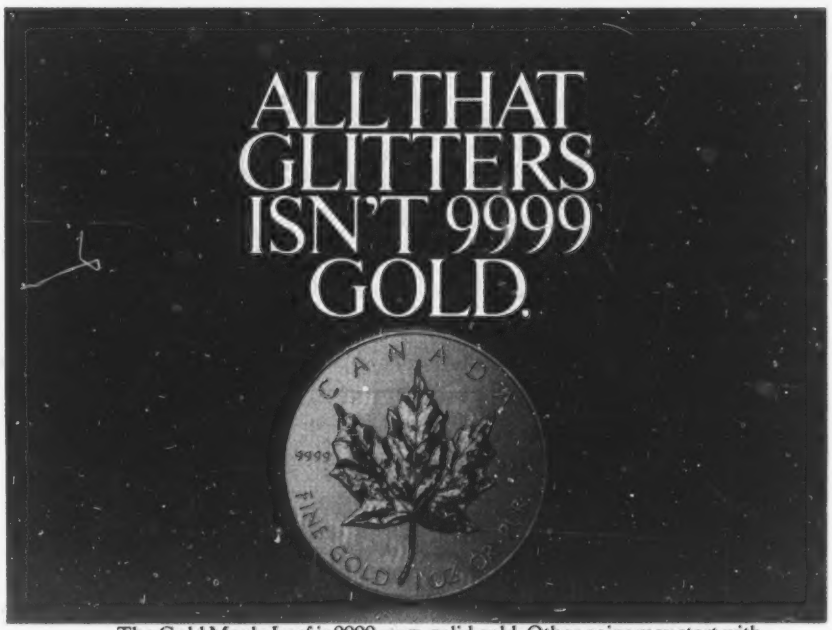
Doing a better job in Japan is only half the battle. Despite their modest penetration of the U.S. market, companies like Nikon and Takeda Riken are beginning to put pressure on American suppliers at home. Chipmakers who have tried Japanese equipment are delighted that the machines often can be set up faster, seem to break down less, and have no trouble meeting their specified performance levels. As an American plant manager puts it, "U.S. equipment is more advanced, but Japanese equipment is more developed." Customers are starting to use the threat of buying Japanese to bludgeon U.S. companies into better performance. Some equipment makers are responding. Varian brags in advertisements that its mask-making equipment can be installed in 19 days; installations used to take more than a month.

RELIABILITY will become increasingly important. So long as customers looked to new generations of aligners, etchers, and other processing gear to raise yield, U.S. equipment companies were able to flog technology at the expense of top-notch execution. The Japanese were at a disadvantage. "The leading edge is a moving target," notes Wilmer Bottoms, a vice president of Varian Associates. "But the Japanese tend to aim at what they have just seen, not at what's about to happen. By the time they hit the target, a new one has popped up." Advances in wafer processing technology, however, seem to be nearing the point of diminishing returns. The costs of improving yield by shrinking the space between the elements on a chip are on the verge of outweighing the benefits. So the Japanese will have more stable technological targets and can bring to bear their talent for execution.

Japan's focus on reliability may also be an advantage as chipmakers move toward automation. DM Data, an Arizona research firm, estimates that eliminating most human handling of wafers on the production line could, by reducing contamination, boost yields about 30%. While U.S. suppliers excel in the software needed to link dozens of different machines into an automated system, the Japanese, most observers think, have the lead in electromechanical technology for handling wafers. In automation, however, pure technology is less important than ensuring that the system always works. Both in today's market and tomorrow's, the prize will go to the equipment companies that make reliability their No. 1 goal. ■



Bill Blass men's shoes, a fitting reflection of American style. For nearest store call 1-800-356-5400.



The Gold Maple Leaf is 9999 pure, solid gold. Other coins may start with solid gold, that they then dilute with base metal. So if you're investing in gold, invest in the solid gold purity of the Gold Maple Leaf.

Canada's Maple Leaf

THERE IS NO SUBSTITUTE FOR PURITY.

Call 800-331-1750 for the Maple Leaf Dealer nearest you.
In Nebraska call 800-343-4300. Ask for Operator # 994.

Canada Royal Canadian Mint / Monnaie royale canadienne

NOTE

ONLY THE FOLLOWING PAGES OF THIS

PUBLICATION HAVE BEEN FILMED

Cov. 1, p. 3, 24.